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RESEARCH ARTICLE

New braconid parasitoids (Hymenoptera: Braconidae) on bark beetles in Ihtimanska Sredna Gora Mountain, Bulgaria

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Abstract

In 2020, two braconid species (Hymenoptera: Braconidae) were found as parasitoids of bark beetles in *Pinus sylvestris* plantations in Ihtimanska Sredna Gora Mt. *Coeloides bostrichorum* Giraud was reared from stem samples attacked by *Tomicus piniperda* and *Tomicus minor* in the region of Krushovitsa vill. (State Forestry Enterprise Elin Pelin), and *Dendrosoter middendorffi* (Ratzeburg) – by *Ips acuminatus*, *Pityophthorus pityographus* and *Pityogenes bistridentatus* in the region of Krushovitsa vill. and Golema Rakovitsa vill. (State Game Enterprise Aramliets). *Coeloides bostrichorum* caused 7.4% mortality of *T. piniperda* and *T. minor*, and *Dendrosoter middendorffi* – 5.6-12.5% of *Ips acuminatus*, 5.6% of *P. bistridentatus*, and 2.8% of *I. acuminatus*, *P. pityographus* and *P. bistridentatus*. In the total braconid parasitoid complex, *D. middendorffi* was the dominant species with a relative share of 87.5%.

Keywords

Braconidae, *Coeloides bostrichorum*, *Dendrosoter middendorffi*, bark beetles, parasitism, Bulgaria

Introduction

The bark beetles (Coleoptera: Curculionidae, Scolytinae) are one of the most dangerous taxonomic groups of insects on forest vegetation. In coniferous forests, species of the genus *Dendroctonus*, *Ips*, *Tomicus*, etc., are the most destructive (Cognato, 2015; Lieutier et al., 2015; Smith, Hulcr, 2015, et al.). Their number is regulated by various natural factors,

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including a numerous complex of parasitoids from different hymenopteran (Hymenoptera) and dipteran (Diptera) families (Kenis et al., 2004; Wegensteiner et al., 2015).

In the last sixty-seventy years, extensive anti-erosion plantations of Scots pine (*Pinus sylvestris* L.) and Austrian pine (*Pinus nigra* Arn.) have been created in the lower and middle forest belts in Bulgaria, where attacks by bark beetles have recently been observed (Mirchev et al., 2016). No investigations on scolytid parasitoids have been conducted in the attacked pine plantations, with the exception of a study that identified six species from Pteromalidae and Heydeniidae families (Hymenoptera: Chalcidoidea) in Ihtimanska Sredna Gora Mt. (Belilov et al., 2023).

The present note reports two braconid parasitoids (Hymenoptera: Braconidae) of bark beetles in pine plantations in Ihtimanska Sredna Gora Mt.

Materials and methods

The studies on parasitoids of bark beetles were conducted in 2020 in two plantations of *Pinus sylvestris* L. in the region of Krushovitsa vill. (State Forestry Enterprise Elin Pelin) and Golema Rakovitsa vill. (State Game Enterprise Aramliets) (Fig. 1).

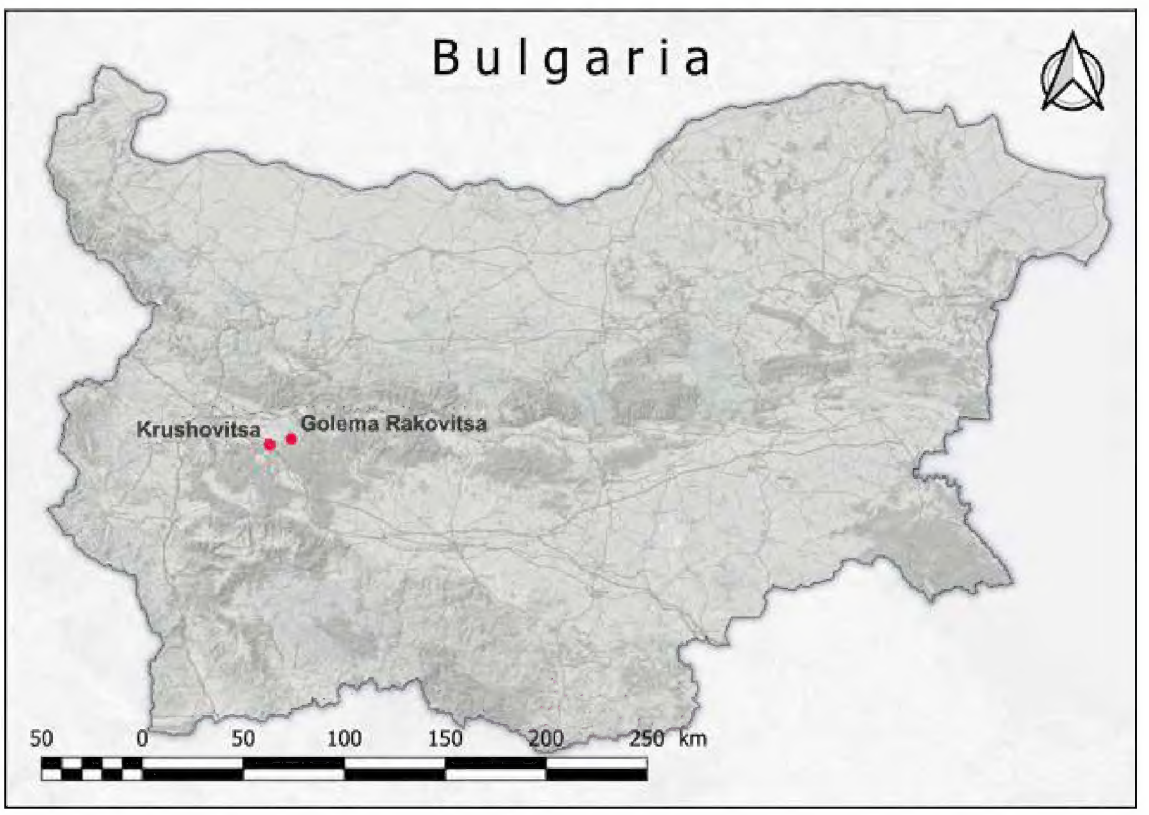

Figure 1. Studied localities of bark beetles in Ihtimanska Sredna Gora Mt.

The main characteristics of the studied plantations are presented in Table 1.

Table 1. Main characteristics of the studied pine plantations

Locality	Geographical coordinates	Altitude, m a.s.l.	Tree species	Age, years
Golema Rakovitsa	N 42.615944, E 23.784333	651	*Pinus sylvestris*	40
Krushovitsa	N 42.590466, E 23.657520	697	*Pinus sylvestris*	55

The samples (cuttings of stems and branches of approximate length 30-35 cm and diameter 5-30 cm) of trees attacked by bark beetles were collected in June.

The biological material was transported to the Forest Research Institute in Sofia where each cutting was kept in a separate photo eclector at room temperature (18-22°C). The samples were observed weekly for the emergence of adult hosts or parasitoids.

The emerged bark beetles were identified using the keys of Karaman (1971) and Grüne (1979), and the parasitoids – using the key of Tobias (1986).

The biological material was deposited in the entomological collections of the Forest Research Institute in Sofia.

Results

In laboratory conditions, two braconid parasitoids (Hymenoptera: Braconidae) were reared from the tree samples. *Coeloides bostrichorum* Giraud, 1872 emerged from samples infested by *Tomicus piniperda* (Linnaeus, 1758) and *Tomicus minor* (Hartig, 1834), and *Dendrosoter middendorffi* (Ratzeburg, 1848) – from samples infested by *Ips acuminatus* (Gyllenhal, 1827), *Pityogenes bistridentatus* (Eichhoff, 1878) and *Pityophthorus pityographus* (Ratzeburg, 1837) (Table 2).

Table 2. Number, parasitism and relative abundance of braconid species in the parasitoid complex

Species	Locality	Host	Sample collection	Emergence period	Number			Parasitism, %	Share, %
					♂♂	♀♀	Σ		
Coeloides bostrichorum	Krushovitsa	*T. piniperda* *T. minor*	05.06.2020	23.07.-02.08.2020	1	1	2	7.4	12,5
Dendrosoter middendorffi	G. Rakovitsa	*I. acuminatus*	05.06.2020	19-27.07.2020	1	1	2	12.5	87,5
	Krushovitsa	*I. acuminatus*	05.06.2020	23.07.-02.08.2020	5	2	7	5.6	
	Krushovitsa	*I. acuminatus* *P. pityographus* *P. bistridentatus*	05.06.2020	02.08.2020	0	1	1	2.8	
	Krushovitsa	*P. bistridentatus*	05.06.2020	27.07.2020	2	2	4	5.6	
Total					9	7	16		100.0

In the total braconid parasitoid complex, *D. middendorffi* was the dominant species with a relative share of 87.5% (Table 2).

Coeloides bostrichorum caused mortality of 7.4% of the population of *T. piniperda* and *T. minor* (Table 2). The mortality caused by *D. middendorffi* varied from 2.8% in the *I. acuminatus*, *P. pityographus* and *P. bistridentatus* population, to 12.5% in the *I. acuminatus* population.

Discussion

The established host-parasitoid associations are well known in the entomological literature (Kenis et al., 2004; Wegensteiner et al., 2015).

Coeloides bostrichorum is widely distributed in the Palearctic and has been reported in many European and Asian countries: Austria, Germany, Czech Republic, Finland, France, Hungary, Italy, Poland, Russia, Slovakia, Sweden, Switzerland (van Achterberg, 2013), Belgium (Hougardy , Gregoire, 2004), Romania (Fora et al., 2014), Turkey (Ünal, 2010), Iran (Ghahari, Fischer, 2011), China (Wang et al., 2006), Japan (Watanabe, 1958). In Bulgaria, it was reported by Tschorbadjieff (1927) as a parasitoid of *Orthotomicus erosus* (Wollaston, 1857) and *Ips typographus* (Doychev et al., 2016). *C. bostrichorum* is known as an idiobiont larval ectoparasitoid of several bark beetles associated with conifers (Kenis et al., 2004). The most common host is *I. typographus*, where parasitism reaches 92% (Feicht, 2006).

Dendrosoter middendorffi is widespread in the Palearctic (van Achterberg, 2013; Yu, 1997-2012; Fora et al., 2014; Basiri et al., 2013). In Bulgaria, the species has been reported as a parasitoid of the bark beetles *Scolytus scolytus* (Fabricius, 1775) (Tschorbadjieff, 1927), *Tomicus minor* (Balevski, Georgiev, 2003), *Pityogenes bistridentatus* (Doychev, Balevski, 2006) and *Ips typographus* (Doychev et al., 2016). The host list of *D. middendorffi* includes many other scolytids, developing mainly on conifers, but also on deciduous trees (Herting, 1973; Halperin, Holzschuh, 1984; Kenis et al., 2004; Basiri et al., 2013; Wegensteiner et al., 2015).

In this study, the braconids caused relatively low host mortality (2.8-12.5%). In the same area (Ihtimanska Sredna Gora Mt.), however, the mortality of bark beetles caused by Chalcidoidea species reaches very high values: 89.6% of *P. bistridentatus*, 90.5% of *I. acuminatus*, and 91.7% of *T. piniperda* and *T. minor* (Belilov et al., 2023).

In conclusion, it should be noted that the discovery of new host-parasite associations expands the knowledge about the ecology of bark beetles in Bulgaria.

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